

**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

In re Application of

Serial n° :09/269,723  
Filed :06/01/99



Group Art Unit :1772  
Examiner :Shalie A. MANLOVE

For :MAGOTTEAUX INTERNATIONAL SA  
Applicant: FRANCOIS, Hubert

#10  
K6  
10-16-01

**DECLARATION UNDER 37 C.F.R. §1.132**

Honorable Commissioner of  
Patents and Trademarks  
Washington, D.C. 20231

Sir :

FRANCOIS Hubert Jacques declares as follows :  
(Name of Declarant)

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OCT 15 2001  
TECHNOLOGY CENTER 1700

1. I am M. FRANCOIS, an Engineer and graduated from the Liège University (Belgium), have been working for 3 years at the Research Centre for Metallurgy (CRM = Centre de Recherche Métallurgique) in Liège (Belgium) before joining the company MAGOTTEAUX S.A. in 1989, my present employer and assignee for the above application.

2. I have been working at the Research and Development Department of the MAGOTTEAUX S.A. in Belgium for 12 years in the field of casting metal.

3. I am the inventor of the above-mentioned application and have therefore full understanding of it.

4. In the prior art, metal salts precursors are used to impregnate metal oxides (Larmie), in a preparation process for abrasive grains, used on abrasive machine tools. In Tamura Akira and Wahl, no mention is made of any impregnation or infiltration. The particles are coated and not impregnated. Furthermore, no solid solutions of  $Al_2O_3$  /  $ZrO_2$  are used. The use of pure  $Al_2O_3$  leads to "hot tearing", which means a crack appearing in the last sections of the casting to solidify in which constraints are present. This is due to differential thermal expansion of the metal and the ceramic padding (insert). Pure  $Al_2O_3$  padding leads to high hardness but, unfortunately, also high brittleness and fragility. The use of pure  $ZrO_2$  increases the tenacity but decreases the resistance to wear because of a low hardness.

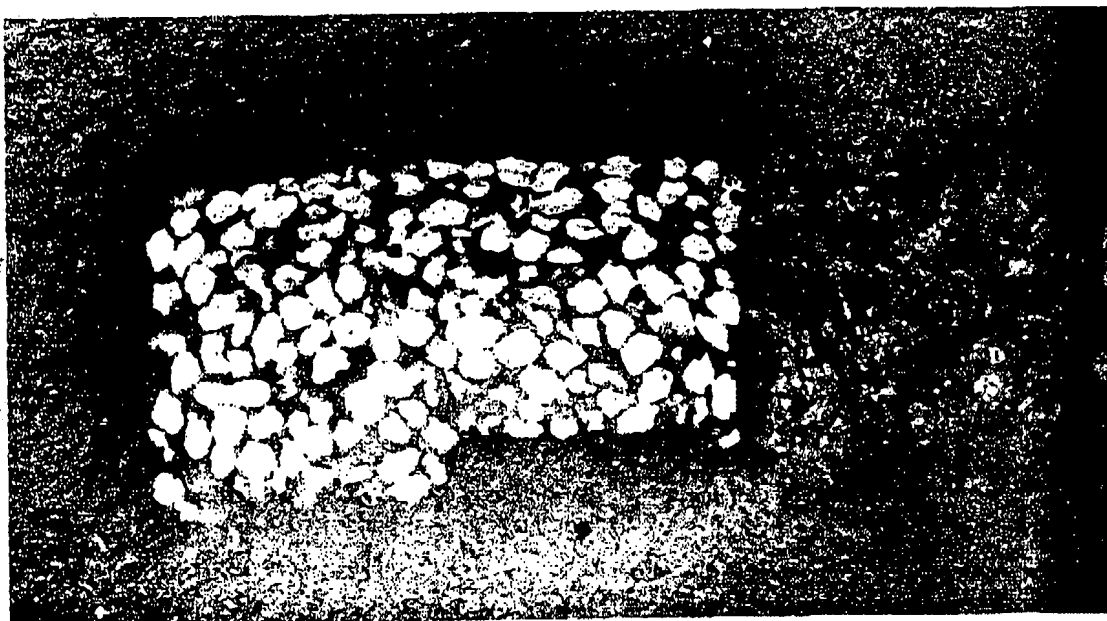
5. In our invention homogeneous solid solution of both ceramics meets the advantages of both  $\text{Al}_2\text{O}_3$  and  $\text{ZrO}_2$  without exhibiting the inconvenients: hot tearing and grain peeling. An unexpected synergy is the result of this solid solution which exhibits better results than each single component contribution especially when embedded in the cast iron or steel matrix.

6. In practice, a lot of combinations of  $\text{Al}_2\text{O}_3 / \text{ZrO}_2$  have been experienced by me and factors like expansion and shrinking, during the cooling phase, are of major importance in this field. The optimum proportions has been obtained empirically. Only solid solutions of  $\text{Al}_2\text{O}_3 / \text{ZrO}_2$  in proportions of 80/20 to 20/80 presents no "microspalling" effects. Other proportions as those defined in the invention was not able to work spalling free in the day to day business. The proportion which is finally used in practice is dependent of the specific application for which the composite wear component is intended. If tenacity is the preferred characteristic, the concentration of  $\text{ZrO}_2$  versus  $\text{Al}_2\text{O}_3$  will be higher, if resistance to wear is the priority, the concentration of  $\text{Al}_2\text{O}_3$  versus  $\text{ZrO}_2$  will be higher. Furthermore, even the balance between the  $\text{Al}_2\text{O}_3 / \text{ZrO}_2$  proportions are adapted to the casting metal-mix to reach more or less the same shrinking coefficients and avoid the above described tearing phenomenon in this way.

The following picture shows cracks in a wear component where pure  $\text{Al}_2\text{O}_3$  ceramic inserts has been used. The cracks are visible in the bottom part of the picture.



In the following picture pure altered  $\text{Al}_2\text{O}_3$  is shown on the left side (hole) and a non altered homogeneous solution of  $\text{Al}_2\text{O}_3 / \text{ZrO}_2$  as described in the invention is visible on the right side .



I further declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further declare that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine and imprisonment or both, under Section 1001 of Title 18 of the United States Code and that such willful statements may jeopardise the validity of the application or any patent issuing thereon.

Respectfully submitted,

By

  
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Date: 10<sup>th</sup> of September 2001